
**U.S. AIR FORCE
SCIENTIFIC ADVISORY BOARD
SUMMER STUDY
ON
SPACE-BASED RADAR (U)**

SEPTEMBER 1987



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SPACE-BASED RADAR

BRIEFING OUTLINE

- ➔ • **INTRODUCTION**
- **REQUIREMENTS**
- **OPERATIONAL CONCEPTS**
- **TECHNOLOGY**
- **ALTERNATIVE SYSTEMS**
- **SYSTEM ACQUISITION**
- **SUMMARY/RECOMMENDATIONS**

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SBR TASK STATEMENT

OBJECTIVE: PROVIDE BASIS FOR FY 88 AIR FORCE SBR DECISIONS. THE STUDY SHOULD ADDRESS THE FOLLOWING TOPICS:

TECHNOLOGY

- **DEFINE RISKS RELEVANT TO PERFORMANCE AND COST UNCERTAINTY**
 - ASSESS PERFORMANCE IN MISSION CRITICAL AREAS, i.e., TARGET DETECTABILITY INCLUDING LOW CROSS SECTION, CLUTTER REJECTION, TARGET IDENTIFICATION, SRT DETECTION, SURVIVABILITY, AND SENSITIVITY TO TASKING**
 - RECOMMEND SBR ROADMAP FOR RELEVANT TECHNOLOGY, ACQUISITION SCHEDULES, EXPERIMENTS/DEMONSTRATIONS, PREPLANNED PRODUCT IMPROVEMENTS**
 - UPDATE ASSESSMENTS MADE BY DSB IN 1984**



SBR TASK STATEMENT—Continued

UTILITY AND ALTERNATIVES

- **ASSESS OPERATIONAL UTILITY/DEFINE ALTERNATIVES**
 - IDENTIFY CAPABILITY OF AN SBR TO COMPLEMENT CURRENT AND PROGRAMMED WIDE-AREA SURVEILLANCE CAPABILITIES**
 - **IDENTIFY PERFORMANCE/COST TRADES BASED ON REQUIREMENTS**
 - CONTRAST SBR AND ALTERNATIVES WITH RESPECT TO PERFORMANCE, UTILITY, AND COSTS**

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SBR TASK STATEMENT—Continued

MANAGEMENT

- **EVALUATE DSB 1984 PROPOSED JOINT ACQUISITION STRATEGY AND RECOMMEND AIR FORCE POSITION ON PROGRAM MANAGEMENT STRUCTURE**
- **DEFINE POTENTIAL INTERNATIONAL (CANADIAN/BRITISH) ACQUISITION STRATEGY**
 - CONSIDER POTENTIAL APPROACHES FOR INTERNATIONAL DEVELOPMENT**
- **IDENTIFY OPERATIONAL MANAGEMENT ISSUES IN MULTIUSER/MULTINATIONAL ENVIRONMENT**
- **ASSESS SECURITY IMPLICATIONS, i.e., INDUSTRIAL, TECHNOLOGY TRANSFER, AND OPERATIONAL**

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SBR COMMITTEE MEMBERSHIP

STUDY CHAIRMAN - DR. ROBERT NAKA

TECHNOLOGY

MR. SAMUEL TENNANT*
DR. WILLIAM BROWN
MR. JAMES KLUCK
DR. DENNIS MURRAY
PROF. ROBERT SHANNON
DR. ALLEN STUBBERUD
MR. VINCENT VITTO

REQUIREMENTS; SYSTEMS ALTERNATIVES

DR. JOHN ALLEN*
LT GEN (RET) BRUCE BROWN
LT GEN (RET) LINCOLN FAURER
MR. EDWIN KEY

OPERATIONAL CONCEPTS; ACQUISITION & MANAGEMENT

MAJ GEN (RET) DAVID BRADBURN*
RADM (RET) ROBERT GEIGER
DR. IVAN GETTING
DR. ALEXANDER FLAX†

AIR FORCE GEN OFFICER PARTICIPANT: MAJ GEN ROBERT RANKINE, SAF/AQS

SENIOR CIVILIAN PARTICIPANT: DR. CHARLES COOK, SAF/AX

NAVY PARTICIPANTS: RADM THOMAS BETTERTON/RADM BRUCE CARGILL

TECHNICAL ADVISORS: DR. J. JAMIESON, LT COL J. BEALE, LT COL E. SIMMONS

AIR FORCE OPERATIONS: LT COL ARTHUR THEOBALD, AF/XOSX

FAA PARTICIPANT: DR. ROY REICHENSACH

SAB EXECUTIVE OFFICER: LT COL ALLISON BARBIER

***PANEL CHAIRMAN**

†MONTEREY ONLY

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SBR COMMITTEE SCHEDULE

12-13 MAR (WASHINGTON) INTRODUCTION TO SBR SUBJECT AREA

24-25 MAR (WASHINGTON) REQUIREMENTS REVIEW

28 APR (LOS ANGELES) TECHNOLOGY PANEL PLANNING SESSION

6-7 MAY (COLORADO SPRINGS) TECHNOLOGY REVIEW

**2-3 JUN (WASHINGTON) ALTERNATIVE SYSTEMS
INTERNATIONAL CONSIDERATIONS
PANEL WORK SESSIONS**

**24-25 JUN (WASHINGTON) UNCONVENTIONAL SBR CONCEPTS
PANEL WORK SESSIONS**

6-16 JUL (MONTEREY) SUMMER STUDY

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HISTORY OF SBR

ALBATROSS THROUGH CLIPPER BOW	(1960-79)
DARPA LENS	(1978-84)
NAVAL RESEARCH LABORATORY	(1980-82)
INTEGRATED TACTICAL SURVEILLANCE SYSTEM	(1980-84)
DEFENSE SUPPORT PROJECT OFFICE	(1981-87)
LINCOLN LABORATORY	(1981-)
DSB SBR STUDY	(1984)
NAVAL RESEARCH LABORATORY	(1986-)
SPACE DIVISION	(1986-)
AIR FORCE SAB SIR-C	(1986-87)
AIR FORCE SAB SBR	(1987)

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REQUIREMENTS REVIEWED

- **OJCS**
- **UNIFIED AND SPECIFIED COMMANDS**
 - NORAD/USSPACECOM, SAC, MAC**
- **COMPONENT COMMANDS**
 - AFSPACECOM, TAC, NAVAL SPACE COMMAND, PACAF, AND USAF**
- **SPACE DIVISION (OF AFSC)**
- **CANADA**
- **UK**



MISSIONS WHERE SBR CAN CONTRIBUTE (U)

- **SUPPORT AIR FORCE IN STRATEGIC CONTINENTAL
AIR DEFENSE**
- **SUPPORT MARITIME FORCES AT SEA IN OUTER AIR BATTLE**
- **SUPPORT AIR FORCE TACTICAL AIR AGAINST TACTICAL AIR
THREAT IN THEATER AND REMOTE AREAS**
- **SUPPORT MARITIME FORCES AT SEA AGAINST SURFACE
THREAT**

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SBR SYSTEM OPERATIONAL CONCEPTS (U)

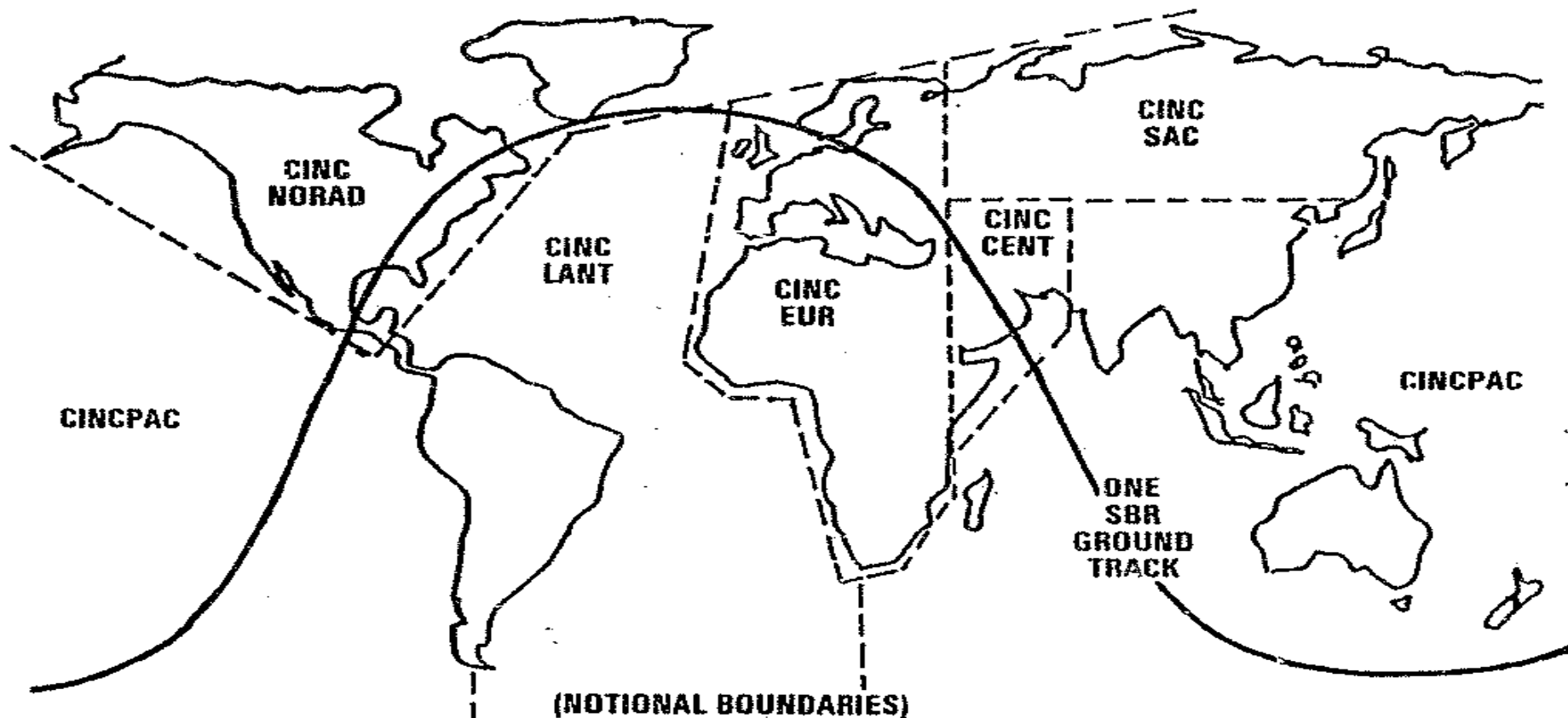
- **OPERATIONAL CONTROL BY USSPACECOM**
- **WORLDWIDE ACCESS, DAY AND NIGHT, ALL WEATHER**
- **ADEQUATE REVISIT CONSISTENT WITH THREAT AND OTHER CONTRIBUTING SYSTEMS**
- **ARCHITECTURE TO PROVIDE**
 - TASKING ACCESS FOR TACTICAL USER**
 - PRODUCT AVAILABLE TO MULTIPLE USERS**
 - DIRECT READOUT**
 - ASSURED DELIVERY OF CRITICAL DATA**
 - ABILITY TO RESOLVE OPERATIONAL AND TASKING ACCESS**
 - STANDARD TACTICAL TERMINALS AND FUSION FORMAT**
 - FUSION OF SBR DATA WITH COMPLEMENTARY DATA**

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GEOGRAPHIC AND TIME ALLOCATION

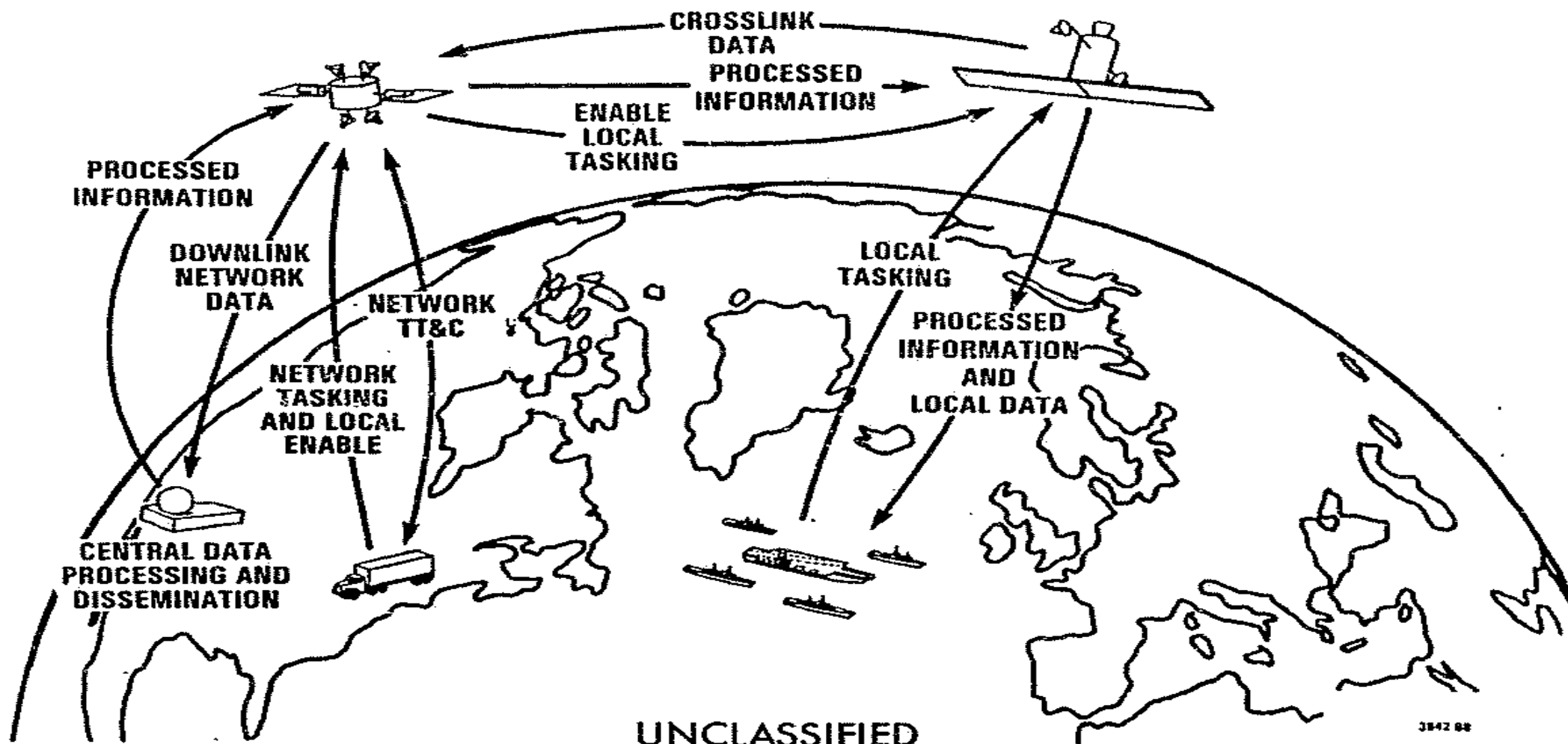
USSPACECOM MANAGES TIME-SHARE AND GEOGRAPHICAL SHARE OF SBR TASKING AMONG CINCs



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REPRESENTATIVE ARCHITECTURE (U)



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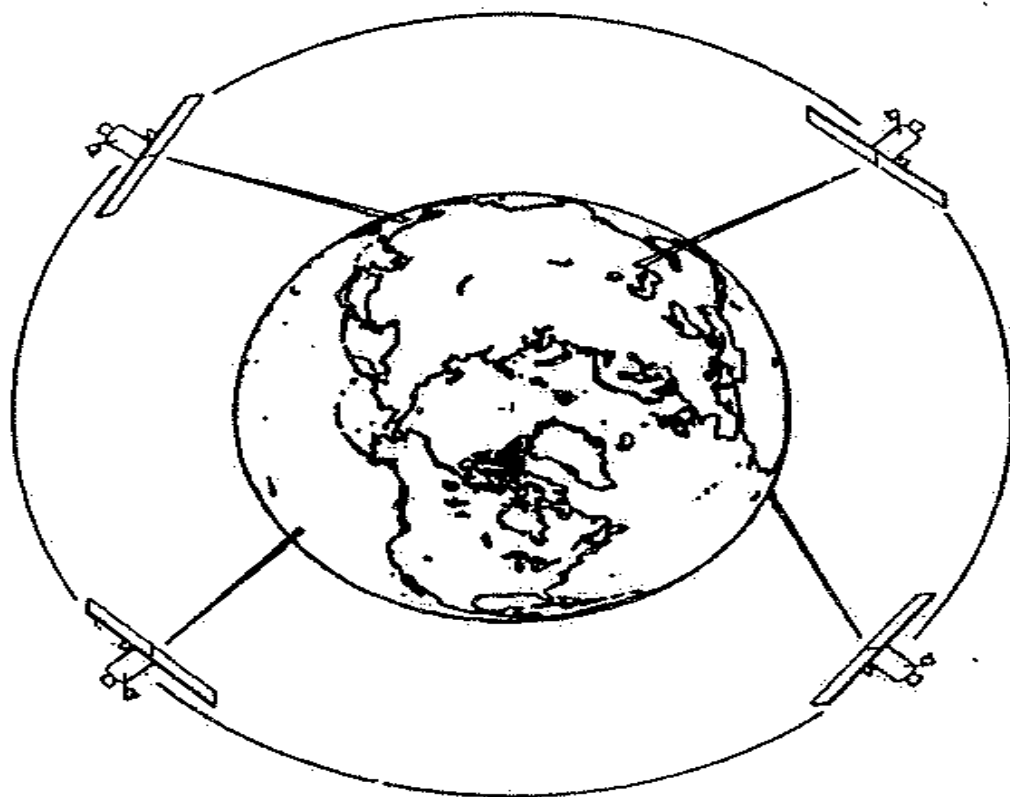
SBR TECHNOLOGY ANALYSIS OF CONCENTRATION

- **INTRODUCTION**
- **RADAR TRADEOFFS**
- **LAUNCH VEHICLE CONSTRAINTS**
- **THREAT RELATIONSHIPS**
- **SBR TECHNOLOGY ISSUES AND ASSESSMENT**
- **SPACE DEMONSTRATION OPTIONS**
- **SURVIVABILITY**
- **FINDINGS**

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GENERAL SYSTEM CONCEPTS SBR DESIGN TRADEOFFS



- VIEWING
- FREQUENCY
- WAVEFORM
- ANTENNA LENGTH
- POWER-APERTURE
- MINIMUM DETECTABLE VELOCITY (MDV)
- ALTITUDE
- POWER-APERTURE VERSUS COVERAGE
- REVISIT TIME

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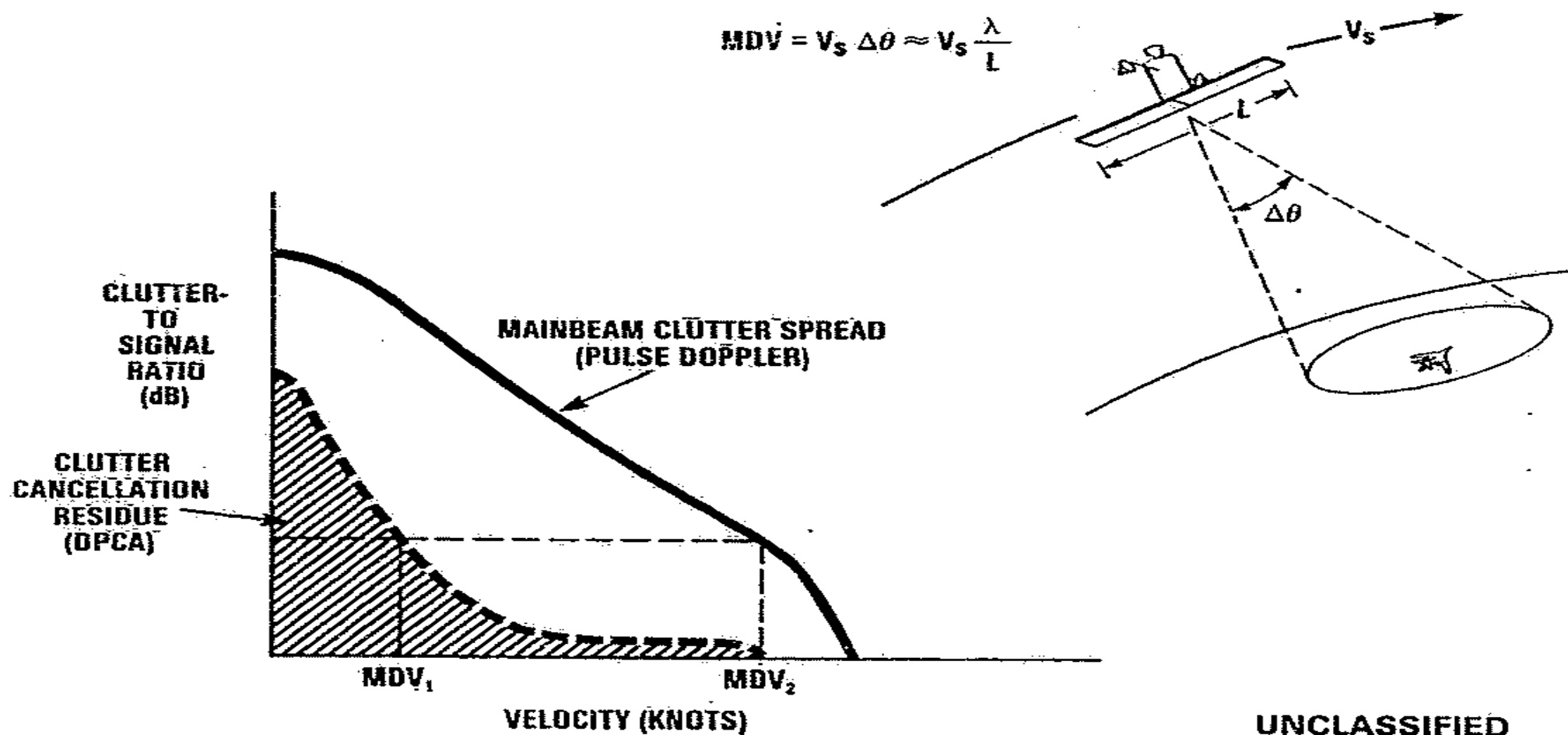
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SBR CLUTTER PROBLEM

$$MDV = V_s \Delta\theta \approx V_s \frac{\lambda}{L}$$



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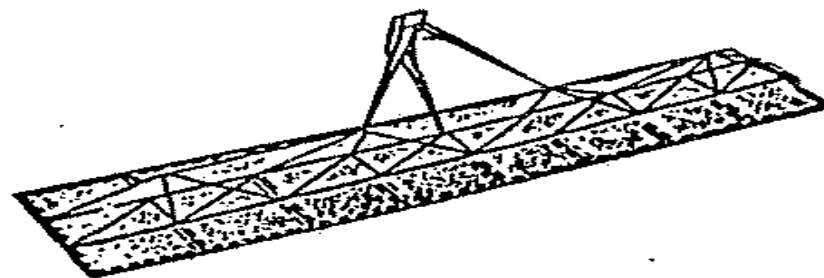


SELECTION RATIONALE: CORPORATE VERSUS SPACE-FED ARRAY

ADVANTAGES

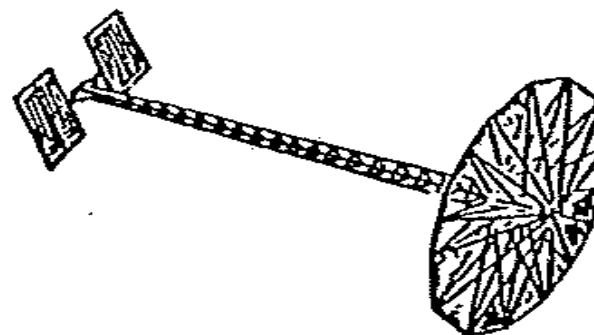
- **CORPORATE**

- LOW-RISK TECHNOLOGY
- SUPPORTS GREATER CLUTTER CANCELLATION
- SUPPORTS GREATER ADAPTIVE NULLING
- CAPABLE OF LOWER SIDELOBES



- **SPACE-FED**

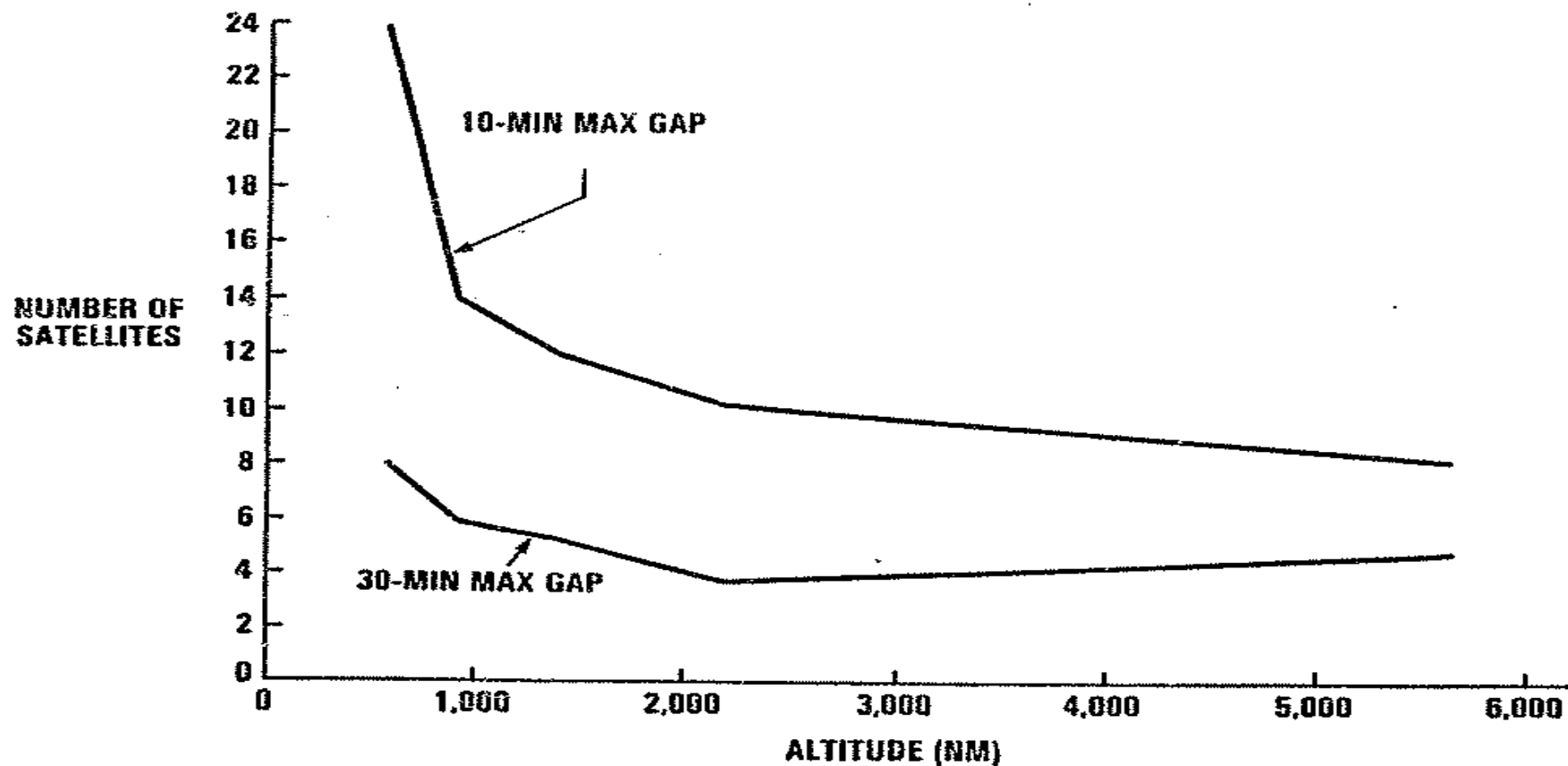
- LOW WEIGHT PER UNIT AREA
- GREATER TOLERANCE TO SURFACE DISTORTION
- ALLOWS GROWTH TO VERY LARGE APERTURES



- **CONCLUSION: CORPORATE-FED APPEARS BEST FOR THE FIRST OPERATIONAL SYSTEM**



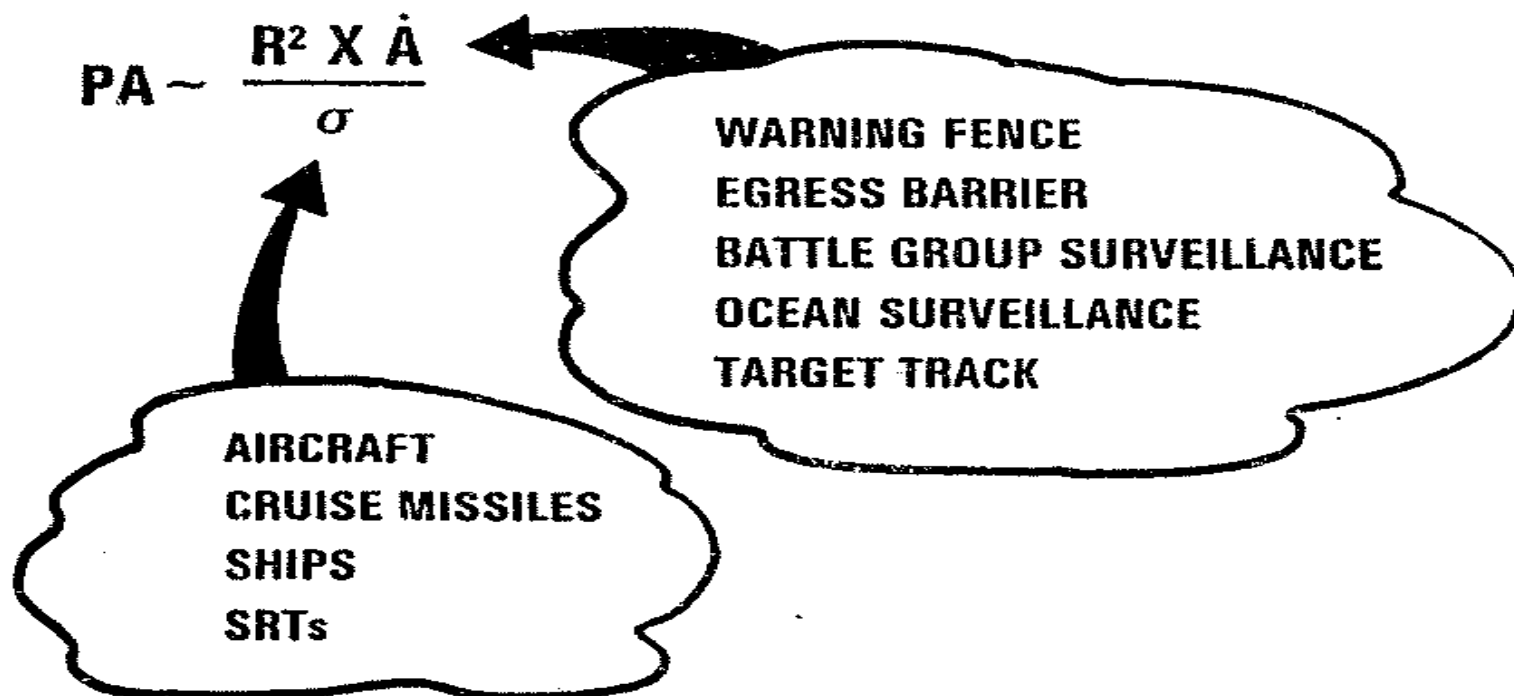
CONSTELLATION SIZE TRADES (U)



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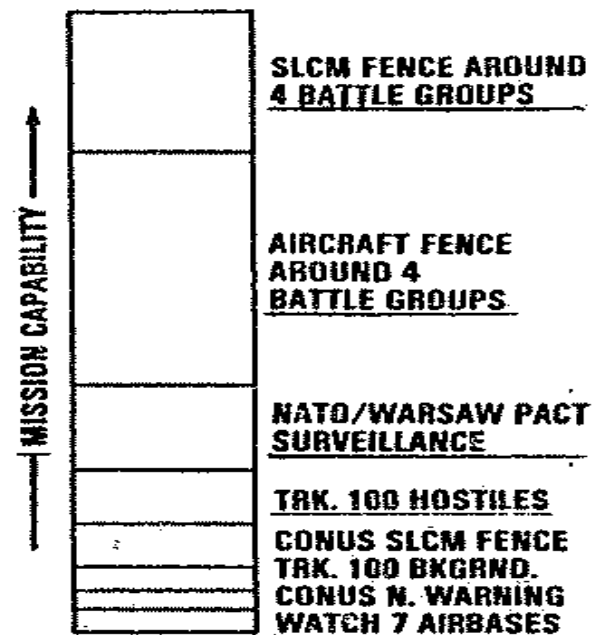
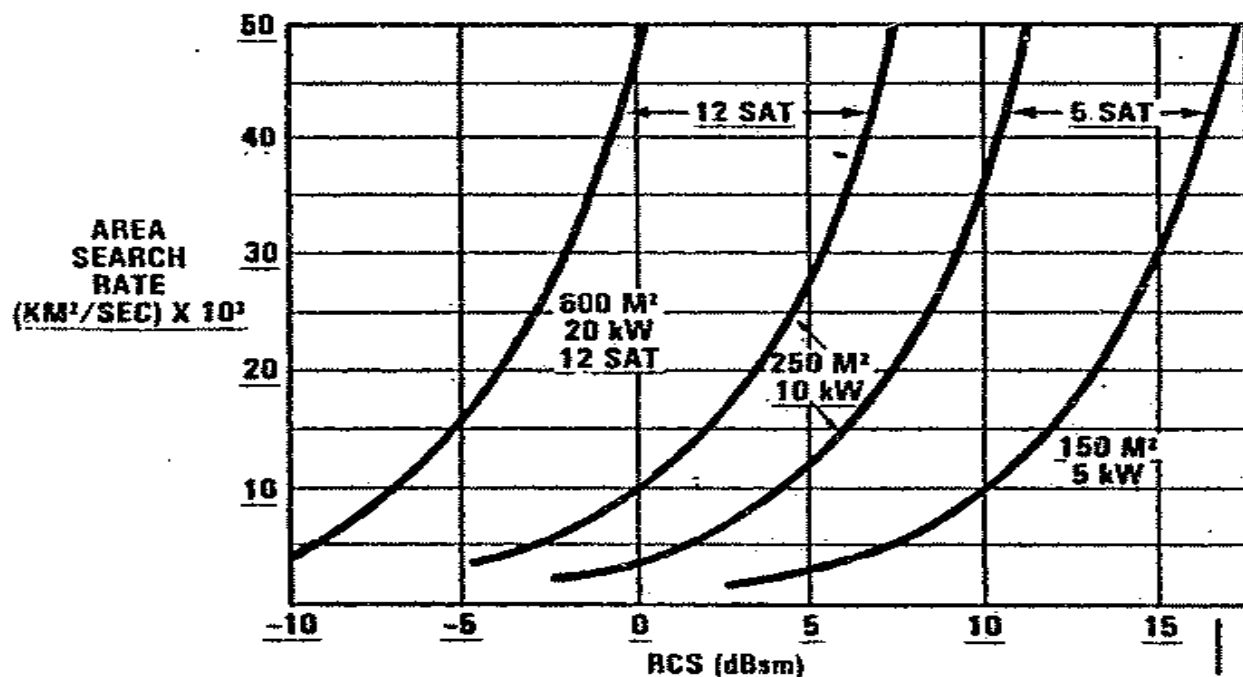


THREATS AND MISSIONS





IMPACT OF RCS ON SBR MISSION PERFORMANCE (U)



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OUTLINE

- **DESCRIPTION OF ALTERNATIVES CONSIDERED**
 - **PASSIVE**
 - **NATIONAL ASSETS**
 - **SBIR**
 - **ACTIVE**
 - **AIRBORNE RADARS**
 - **AIRSHIP RADARS**
 - **OTH RADAR**
- **COMPARISONS OF ALTERNATIVES**
- **SUMMARY**

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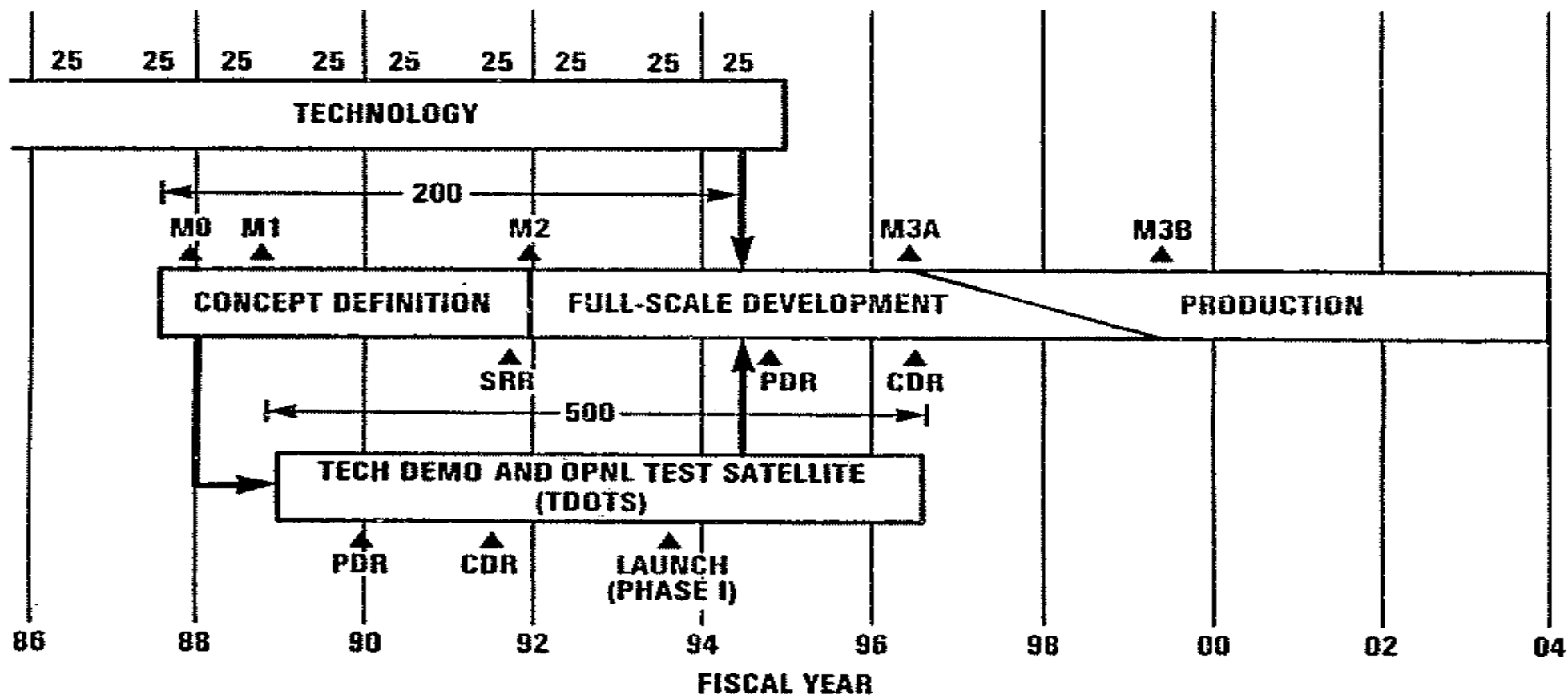
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REPRESENTATIVE SBR PROGRAM PLAN

FUNDING (MILLIONS OF 1987 DOLLARS)



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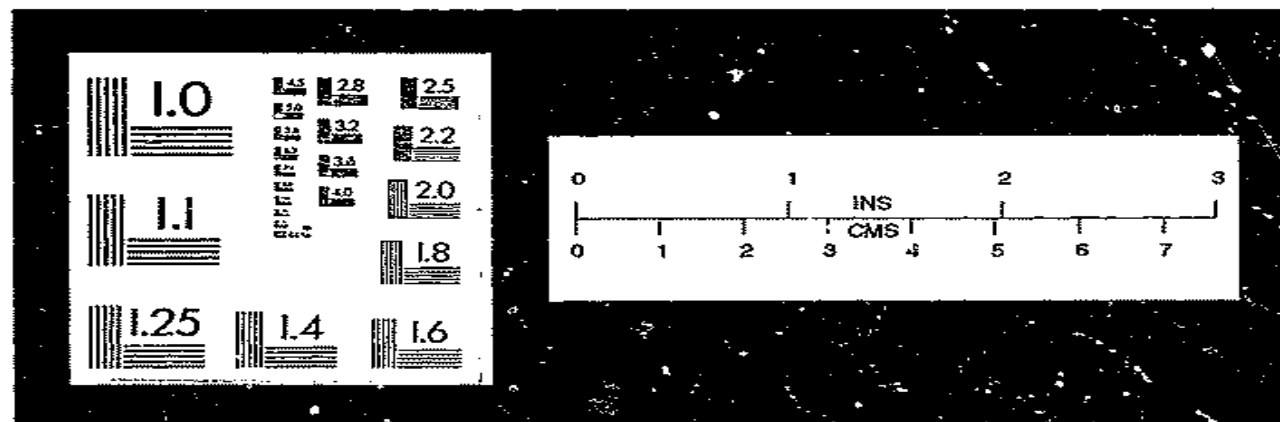
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IMMEDIATE STEPS: SYSTEM ACQUISITION

- **PROCEED WITH SD INDUSTRY STUDIES**
- **REDIRECT EFFORT OF STUDIES TO COST-CONSTRAINED PHASE I PLUS STUDIES FOR PHASE II**
- **OBTAIN \$25 MILLION IN FY 89 FOR CONTINUATION OF PHASE I AND PHASE II R&D (PRESUMABLY BY BUDGET ADJUSTMENT OR REPROGRAMMING)**
- **ESTABLISH SBR SYSTEM PROGRAM OFFICE (SPO)**
 - AIR FORCE DIRECTOR
 - NAVY DEPUTY
- **START POM ACTION FOR PHASE I AND PHASE II**
 - IN AIR FORCE BUDGET
 - SERVICES (PARTICULARLY NAVY) HELP JUSTIFY

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RECOMMENDATIONS: SPACE-BASED RADAR (U)

- **IMPLEMENT A CAREFULLY PHASED SPACE-BASED RADAR PROGRAM NOW**
- **SBR DESIGN AND OPERATIONAL CONCEPT SHOULD CAPITALIZE ON PLANNED OTH DEPLOYMENT AND NATIONAL SYSTEMS**

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